The Legacy of Pōkāneloa

Issues:

Pōkāneloa, a large flat pōhaku with equally spaced purposefully carved divots and lines, is treacherously close to toppling into a ravine widened by increased overland water flow due to decades of erosion and denuded vegetation. There is limited funding and manpower. There are too few people that really understand the purpose of Pōkāneloa.

Recommendations from the Watershed Consultants to protect the legacy of Pōkāneloa:

1. Move Pōkāneloa to either
    a. the opposite side of the gulch - the ʻāina appears less susceptible to the ravine sprawl, or
    b. further in on the same side of the gulch - slow the widening ravine with vegetative growth.
2. Digitally photograph Pōkāneloa with a stick at distinct morning intervals to record the movement of the sun in order to preserve a photographic record of the function of Pōkāneloa.

Personal Statement:

Prior to driving to the area where Pōkāneloa sits, the team gathered in the covered sitting area near the coastline. Here we were given background information on the physical conditions of the surrounding area where Pōkāneloa sits as well as the economic and political issues involved with proposing any solutions. At that time, I felt the presence of another being that was among us. Out of respect for the being (and because I did not know with whom I was dealing), I silently acknowledged its presence and asked that it reveal its purpose for joining our discussion. About the time we were being told that this rock was special (there are only one/two other similar rocks that have been identified on other islands), I was being "told" to find the other rock(s). At the time, I believed the other rock(s) were those similar rocks being discussed that existed on the other islands. However, I silently agreed to leave myself open to other possibilities.

Upon arriving at the site, I was initially confused by the excess energy being emitted from the area. There is a lot of lingering interests from times past that converges on the area. I had to sit and let myself settle down. I could not "think". I focused on what the others were doing to help me focus on something other than the "confusion" that would restrict me from being able to function as I anticipated. I was trying too hard, but I did not know how to stop myself from feeling inept.

Thankfully, the other team members wanted to go back the next morning to watch the sun's shadow dance across the rock. They wanted to see it in action. By this time I had gotten a full night sleep and realized I needed to "not think." Thus, was able to make more careful observations of the surrounding area. I noticed another rock further from the edge of the gulley with divots placed on its side. Those divots appeared to line up with the lines carved across the face of Pōkāneloa. Could this be the other rock?

It took a long, long while - several nights of purposeful dreaming - to arrive at the hypothesis that this other rock was for tracking the noon day sun. If this is a correct assumption, this area is far more important in demonstrating Hawaiians depth of understanding locational positioning. When I heard Hawaiians built Heiau to track the sun's progression across the horizon, it stood to reason that Hawaiians would also notice the length and direction of shadows cast during the day. If indeed the area surrounding Pōkāneloa was used to track the movement of the sun, it is quite possible Hawaiians understood how the

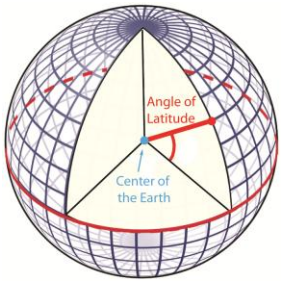
length and direction of shadows indicate where each place existed locationally, or more accurately – latitudinally. Let me explain.

Locational positioning

Before the development of modern navigational aids, many societies tracked the sun's transit across the sky by watching shadows, specifically, the shadow created by a gnomon (pronounced "NO-mon") or a vertical pointed stick fixed in place over a period of time. The sun can be used to determine latitude by observing the shadow left by a gnomon of known length at noon on the solstices and equinoxes. While mathematical theorems exist, I prefer to use some real world examples with pictures that make sense from a practical standpoint.

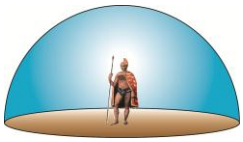
Background

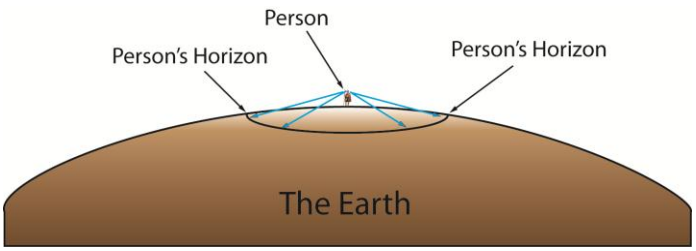
First things first, I want to be sure the concepts are defined. While I agree, Hawaiians would not use this terminology, I do not fully understand how Hawaiians understood spatial location on a global level nor do I know how or if they would use the sun and shadows to determine their place on the earth. So, I will start with what I know and work towards what I believe happened.



Latitude specifies the north-south position of a place on the Earth's surface. It is determined by the angle formed by a line from a point on the Earth's surface to the center of the Earth with respect to the equatorial plane. A line connecting all the points with the same latitude is called a "line of latitude". All lines of latitude are parallel to the equator and are sometimes referred to as "parallels".

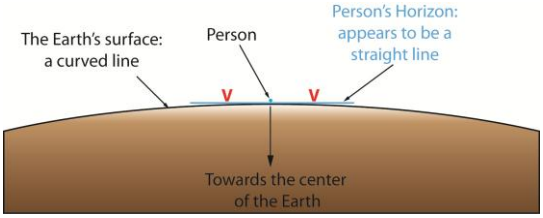
Now, practically speaking, we should consider how the world looks to the average person. The average person sees something that looks like a dome for the sky and what appears to be a vaguely curved (nearly flat) horizon.





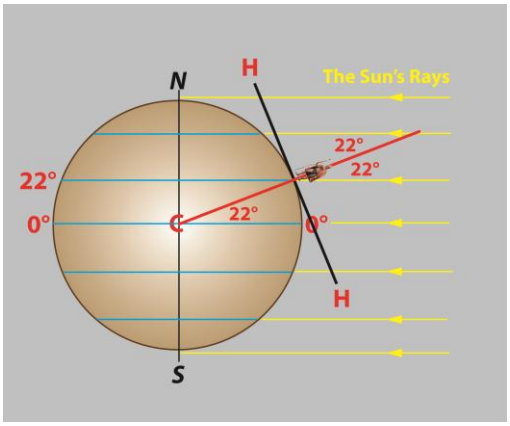
When we place this person in the context of the Earth, we see that a person can only see the closest part of the Earth's surface when looking in all directions. The places further off are hidden by the curve of the Earth. The part the person can see is roughly a circle bounded by the horizon.

In reality, the above diagram is rather distorted as the person is much too large compared to the size of the earth. If you scaled the Earth to the size of a bowling ball, the highest mountains and lowest trenches in the ocean would be negligible to the touch. In other words, the earth size bowling ball would "feel" smooth. Another way of depicting this is with a cross section.

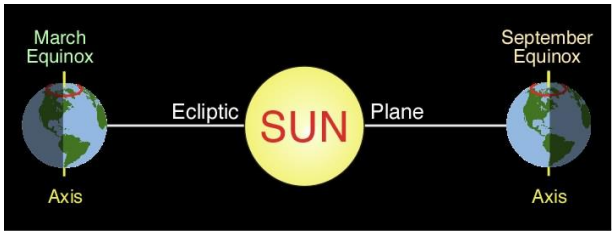


In this diagram, you can see that the curve of the Earth is closer to a straight line. In fact, the limits of a person's vision (the horizon), indicated by two red arrowheads, makes the Earth appear to be flat. Notice that the line to the center of the earth is perpendicular to the straight line.

Let's put all this together on a cross section of the Earth. By placing an exaggerated image of the person on the Earth's surface and adding the sun's rays, we can see how the shadow from a stick plays a role in determining the latitude of a place on the surface of the Earth.



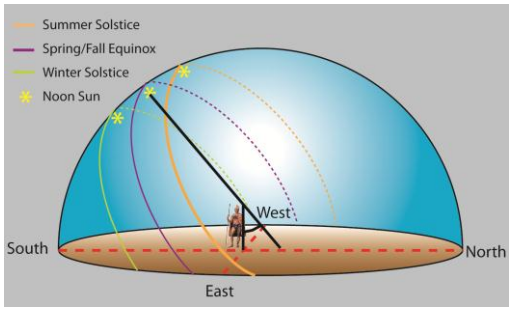
Of course, this only works at noon during the equinoxes, when the axis of the Earth is not tilted toward or away from the Sun and the circle of illumination cuts through the poles.



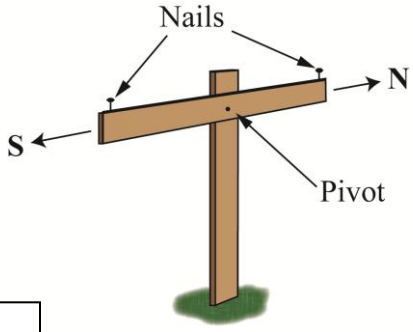
Source: http://www.physicalgeography.net/fundamentals/6h.html

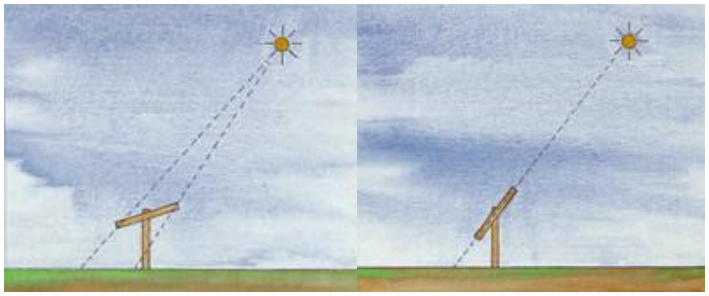
This does not imply that the 23.5° tilt of the Earth does not exist. It means the vantage point of the graphic shows the Earth's axis is inclined toward the viewer for both dates. Day lengths on both these days, regardless of latitude, are exactly 12 hours.

But why only at noon? Because that is the time when the sun is directly overhead. Let's look at the sun shadow from the dome diagram. At noon on the equinox, the angle made from the top of a gnomon to the end of its shadow is the same as the latitude of the place. However, this method requires accurate measurements and mathematical formulas. Thus, the average person cannot easily acquire their latitude upon observation alone.



Another way of obtaining latitude is by orienting a pivoted beam with nails on the aiming arm along the North – South Axis. At noon, tilt the aiming arm to align the shadows created by the nails such that they overlap. The angle formed by the post and the aiming arm will be your latitude on the Equinox.



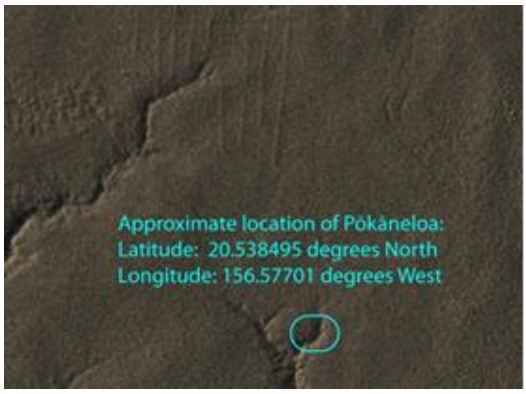


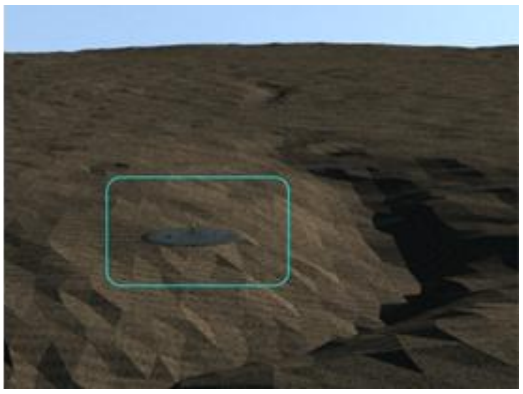
Source: http://www.pbs.org/weta/roughscience/series1/challenges/latlong/page4.html

Reality Check

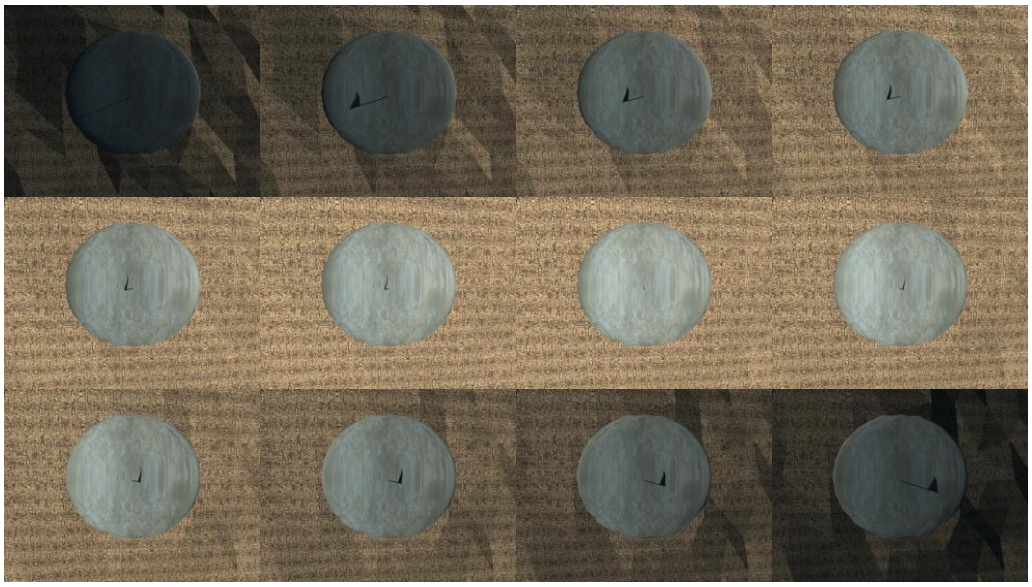
This is great, but there is no evidence that Hawaiians were interested in angle measurements. This does not mean that they were not interested in the movement of the sun. To the contrary, Hawaiians were acutely aware of astronomical movements and natural phenomenon. I know am preaching to the choir because Pōkāneloa is proof that Hawaiians tracked and recorded the seasonal the movement of the sun. But what exactly did the caretakers witness? What did they really see?

In order to witness the sun's movement without sitting and observing it for a year or more, I utilized a program called World Construction Set (WCS) to provide the answer to that question. WCS is capable of uploading digital elevation models (DEMs), generating 3D objects, and allowing them to cast shadows based on the time of day, among other things. Unfortunately, high resolution data does not exist for this area. The best I could find was 5 meters for each pixel. Since Pōkāneloa is smaller than 5 meters, I had to improvise. The following images show the approximate location of Pōkāneloa along Kāneloa Gulch from planimetric (overhead) and oblique views, left and right images respectively.

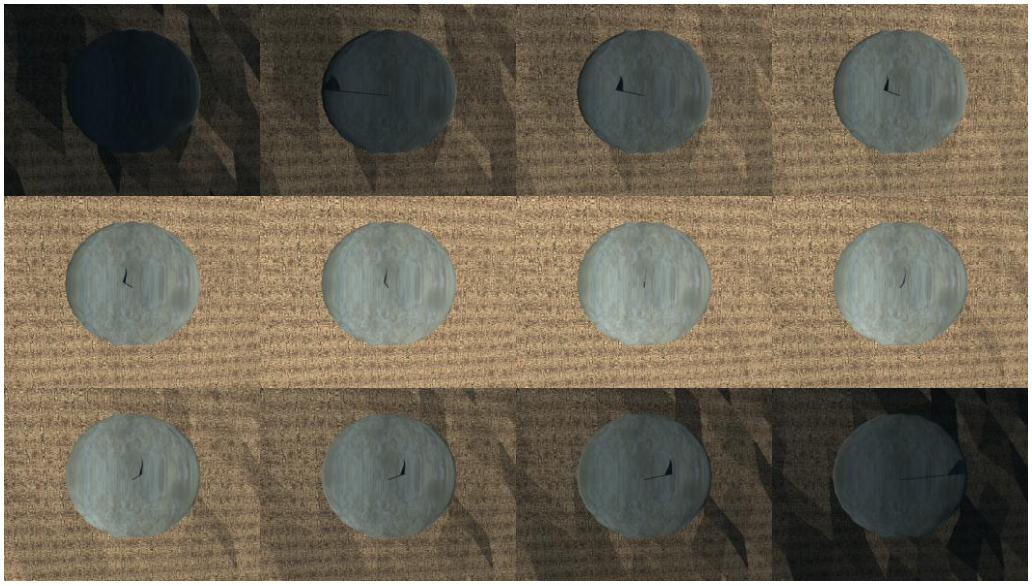




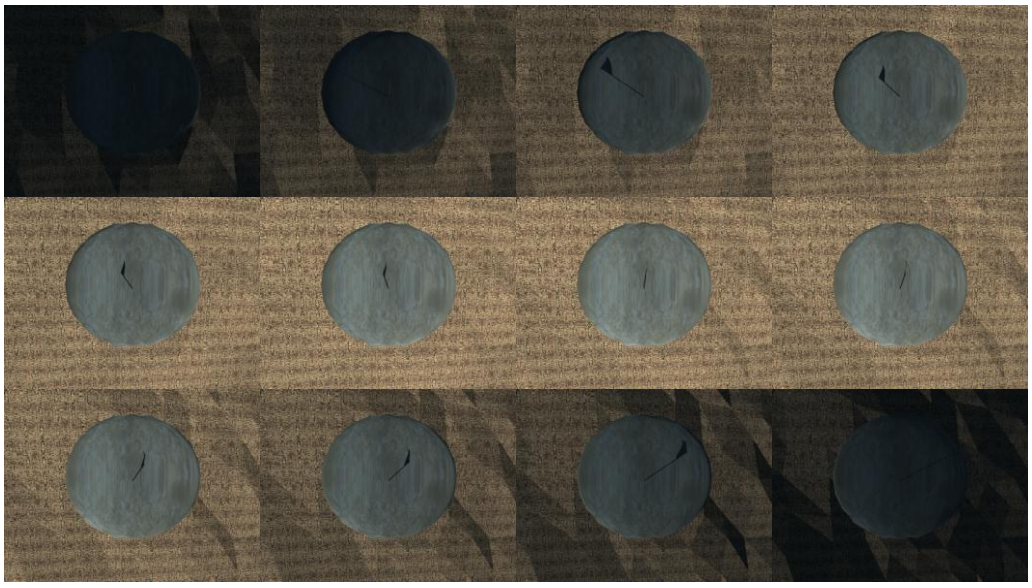
Grainy, I know, but better resolution will produce a better image. If you look closely at the oblique or right image, you may see a flag in the middle of the rock and a shadow cast by the flag. It is a crude attempt to create a sundial in the approximate location of Pōkāneloa. Now, situating a camera directly over Pōkāneloa and changing the date to Jun 21, Sep 21 and Dec 21 each from 6 am to 5 pm gives the following images.



June 21 6:00 am to 5:00 pm

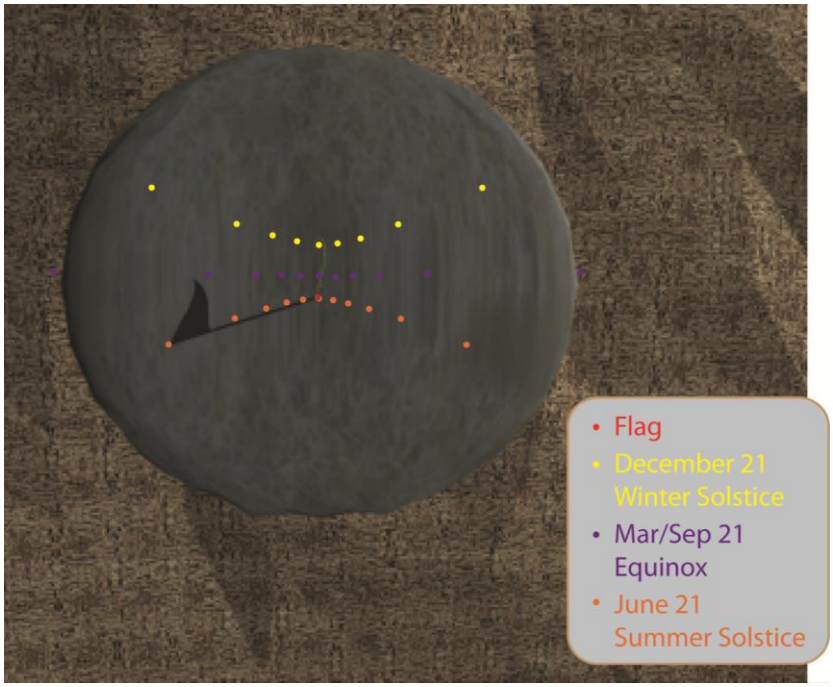


September 21 6:00 am to 5:00 pm



December 21 6:00 am to 5:00 pm

Overlaying each image in Illustrator and marking the endpoint of the flag gives the following image.



This is a quick and easy way to view the sun's shadows without having to be physically in the location. The program is also able to identify the exact date that the sun is directly overhead, May 24-25 and July 18-19. However, it does not help demystify the alignment of lines from the other rock as shown below.

Recommendation:

More needs to be recorded about the purpose of Pōkāneloa and its surrounding rocks. Like many places on Kahoʻolawe, Pōkāneloa is threatened by natural forces, specifically erosion and storm damage, as well as from the possibility of human mismanagement. Whomever takes on the future stewardship of this pōhaku should continue the process of identifying and gathering more information about its connection to astronomical events. Furthermore, an active and ongoing program should be initiated to help preserve the condition of Pōkāneloa and the pōhaku in its immediate vicinity. The goal of the program shall be to reconnect with the purpose of Pōkāneloa, share this knowledge with appropriate cultural protocols, and ultimately allow future generations to visit and perform cultural practices in a safe setting.

Sidebar:

On Jan 18, 2012 I acquired 1950 and 2000 aerial stereo photo pairs for the area. I have put in a request to have a friend create a 3d image from these photos. Yes, images that you can see in 3d with special glasses. I thought it might help determine the rate of erosion the area has experienced over those 5 decades. If it turns out to be a significant amount, it could emphasize the threat level and perhaps help put a fire in people's pants to do something to save this unique cultural feature.